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None

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(54) Production of textile and other articles

(57) A body of treated microfungal hyphae, which may be a filter, a wound dressing or an incontinence pad, is produced by pouring a slurry of washed and/or alkali treated fungal mycelia into moulds or onto a continuous paper-making apparatus, freezing it and freeze-drying the resulting product. Fibres such as manila hemp, glass, viscose, polypropylene, polyester carbon, wood pulp or cotton may be incorporated. Deacetylised fungal filter pads may be used to recover copper, zinc, mercury or silver from solution.

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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

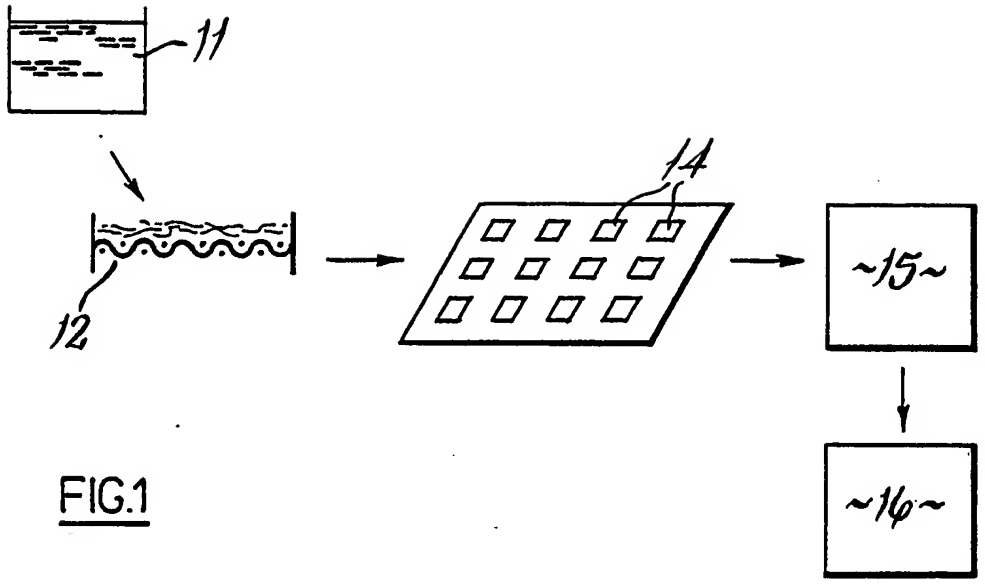

FIG.1

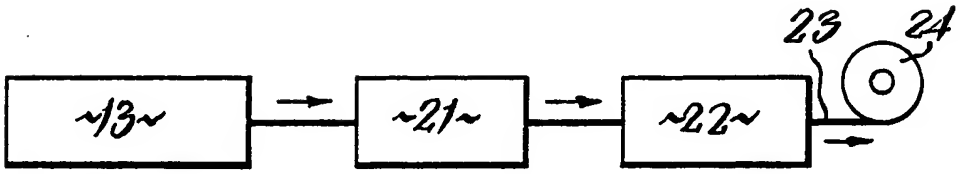

FIG.2

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FIG.3

SPECIFICATION

Production of textile and other articles

This invention relates to the production of textile and other articles.

In our UK Patent Application Nos. 8525265 (Publication No. 2165865) and 8426032 (Publication No. 2148959) we have described the production of non-woven fabrics from microfungal hyphae. The techniques therein described involve forming a wet-laid matt and drying the same.

In one of the methods described, the hyphae are mixed with another fibre, having been treated to expose their chitin. In another of the methods, brittleness is avoided by the addition of a plasticiser.

We have now found that microfungal hyphae matts can be prepared without the addition of another fibre and without a plasticiser, yet not be unduly weak or brittle and quite capable of being formed into useful articles which will withstand regular handling and exhibit a degree of resilience and soft handle.

The invention comprises a method for treating microfungal hyphae comprising forming a matt therefrom and freeze-drying the same.

The hyphae may be treated with alkali prior to freeze-drying, in such strength and under such conditions as to remove protein to yield a non-allergenic material for wound dressings, or to de-acetylise the chitin.

The hyphae may also be bleached prior to freeze-drying.

A shaped matt of wet hyphae can be frozen and then freeze-dried to form an object such as an absorbent pad for use e.g. in incontinence control, or a wound dressing or a filter.

Or a matt of fabric can be produced continuously by passing a wet-laid matt through a continuous freezer then a continuous freeze drier. The nature of the emergent dried matt is such as will allow it to be rolled up.

Methods for treating microfungal hyphae according to the invention and products made thereby will now be described with reference to the accompanying drawings, in which:

Figure 1 is a diagrammatic illustration of a batch process for making shaped articles,

Figure 2 is a diagrammatic illustration of a continuous process for making a non-woven web or fabric, and

Figure 3 is a scanning electron microscope photograph showing the micro structure of the material produced.

Examples of organisms which may be used are:-

Aspergillus malignus	Shirley isolate
Aspergillus oryzae	CMI 87 159
Fusarium graminearum	CMI 145 425
Mucor mucedo	CMI 184 726
Neurospora crassa	Strain ORa (Dept. of Genetics, Univeristy of Sheffield)
Rhizopus stolonifer	CMI 183 697
Trichoderma viride	CMI 92 027

These organisms may be grown in fermenters (11, Figure 1) at for example 30°C on a medium containing malt extract and mycological peptone for 2–3 days.

Washed or alkali-treated mycelia may be disintegrated and wet-laid using normal paper making techniques e.g. by draining through a wire grid – 12, Figure 1 – or on a continuous paper making machine 13, Figure 2.

The mycelia may be simply washed in water until a neutral pH is obtained, or subject to alkali treatment. Boiling in 1 or 2 molar sodium hydroxide for one hour will remove all protein to result in a non-allergenic product suitable for wound dressings or incontinence pads. More thorough de-acetylisation of the chitin to yield chitosan is effected by 40% caustic soda solution.

Although it is not necessary, using the technique of freeze-drying of the present invention, additional fibres can be blended in with the microfungal hyphae prior to the wet-laying operation. Fibres such as manila hemp, glass, viscose polypropylene, polyester, carbon, wood pulp and cotton can all be used.

For 100% fungal matts it has previously been necessary to include a plasticiser such as glycerol or polyethylene glycol.

With freeze-drying this is unnecessary, although it may still be done if desired, of course.

Alkali treated mycelia maybe bleached by adding peroxide solution (e.g. 80 ml/l 37% H_2O_2 + 40 g/l sodium silicate) to the alkaline suspension and incubating for two hours at room temperature. The bleached hyphae are then washed until a neutral pH is obtained and resuspended in water to produce a thick slurry.

For the preparation of shaped articles by a batch process, the slurry is poured in to shaped moulds or dishes 14, Figure 1 which are then frozen in a deep freeze 15 for say sixteen hours and then freeze-dried for 28 hours in a freez -drier 16. Pads typically of say 10 cms in diameter or larger and from a few millimetr s t several centimetres thick can be produced in this way.

Figure 2 illustrates a continuous process f r producing a web in which a slurry is laid down using conventi nal paper making techniques and passed straight into a c ntinuous freezer 21, Figur 2 and fr m there into a continu us fre ze drying plant 22 after which the resulting matt 23 can be r ll d up as at 24.

It is surprising that th matt is so flexible and str ng as to permit this since, previously, 100% fungal matts have been brittle unless plasticiser has been added.

The water abs rbency of microfungal pads prepared by freeze-drying mycelium of asp rgillus oryza has be n compared with that of conventional absorbent materials. The comparis n is shown in Table I.

Figure 3 is a scanning electron microscope photograph of a section of a typical freeze-dried pad of microfungal hyphae. It will be seen that there is considerable bonding between hyphae that gives rise to the coherence of the pad.

Freeze-dried products may be used, in addition to the specific uses mentioned, as filters and especially for recovering metals such as copper, mercury, zinc and silver from solution. Since such recovery depends upon binding by chitosan or partially de-acetylated chitin, 100% fungal matts are clearly to be preferred to hybrid matts.

TABLE I

Sample	*Sinking Time (secs)*	*Water Absorbency (g per gram of sample)*	
Microfungal Pads	5	15.59)	
	2	18.91)	17.52
	1	18.06)	
Cotton Linters	2	13.86)	
	3	13.19)	13.38
	2	13.08)	
'Sound View'	10	12.52)	
fluffed wood pulp	15	12.66)	12.63
	9	12.72)	
Non-perforated	2	9.43)	
cellulose cloth	1	10.91)	10.91
	1	10.23)	
Sanitary towel	2	17.67)	
(Dr White's)	2	11.50)	13.13
	2	10.22)	
Incontinence pad	17	18.77)	
(Boots aids)	22	17.55)	17.98
	21	17.63)	

CLAIMS

1. A method for treating microfungal hyphae comprising forming a matt therefrom and freeze-drying the same.
2. A method according to claim 1, in which the hyphae are treated with alkali prior to freeze-drying.
3. A method according to claim 2, in which the hyphae are treated with alkali in such strength and under such conditions as to remove protein to yield a non-allergenic material suitable for wound dressings.
4. A method according to claim 2, in which the hyphae are treated with alkali in such strength and under such conditions as to de-acetylise chitin therein.
5. A method according to any one of claims 1 to 4, in which the hyphae are bleached prior to freeze-drying.
6. A method according to any one of claims 1 to 5, in which a shaped matt is prepared, frozen and then freeze-dried.
7. A method according to any one of claims 1–6, in which a continuous matt is laid down, frozen by passing through a continuous freezer and then freeze-dried by passing through a continuous freeze-drying apparatus.
8. A method according to claim 7, in which the continously freeze-dried matt is rolled up.
9. A method for treating microfungal hyphae substantially as hereinbefore described with reference to the accompanying drawings.
10. An article made from freeze-dried microfunal hyphae in the form of a pad or matt.
11. An article according to claim 10, comprising an incontinence pad.
12. An article according to claim 10, comprising a wound dressing.
13. An article according to claim 10, comprising a filter.
14. An article according to claim 10, comprising an insulating layer.
15. An article according to any one f claims 10 to 14, comprising ther fibres mixed in with the hypahe.
16. An article made fr m freeze-dried microfunal hyphae substantially as hereb fore describ d with reference t the accompanying drawings.

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